

REMARKS

Claims 1-4 and 6-12 are pending in the application. Claim 2 has been cancelled by this amendment. Claim 5 previously was cancelled. New claim 13 has been added to the application. Therefore, claims 1, 3, 4, and 6-13 are at issue.

Claim 1 has been amended to recite that the nitrogenous polymer is a hydrolysis product of a homopolymer of N-vinylformamide having a degree of hydrolysis in the range from 30 to 80 mol%. Support for this amendment to claim 1 can be found in original claims 2 and 4, and in the English-language specification at page 4, lines 14-35. Claim 12 has been amended to improve the form of the claim. New claim 13 is supported in the specification at page 6, lines 36-41.

Claims 1-4, 6, and 8-12 apparently stand rejected under 35 U.S.C. §103 as being obvious over Torii et al. U.S. Patent Publication No. 2003/0069359 ('359 publication) in view of Freedman U.S. Patent No. 4,478,938 ('938 patent). The Office Action refers to a rejection of claims 1-5, but applicants assume this is a typographical error. Claim 5 was previously cancelled and claims 6 and 8-12 are referred to in the rejection. Claim 7 stands rejected under 35 U.S.C. §103 as being obvious over the '359 publication in view of Nagasuna et al. U.S. Patent Publication No. 2004/0019342 ('342 publication). In view of the amendments to the claims, and for the reasons set forth below, it is submitted that these rejections should be withdrawn.

The present claims recite a water absorbent, and a process for producing a water absorbent, comprising (a) particles of a water absorbent polymer and (b) a nitrogenous polymer having (i) a high molecular weight of 100,000 to 500,000 daltons, (ii) a moderate protonatable nitrogen atom content of 7.5 to 15 mol/kg, and (iii) wherein the nitrogenous polymer is a hydrolysis product of a homopolymer of N-vinylformamide having a moderate degree of hydrolysis in the range from 30 to 80 mol%.

The '359 publication discloses a water-absorbing agent obtained by blending water-absorbent particles (A) and a cationic polymer (B) (see '359 publication, paragraph [0030]). The '359 publication discloses a cationic polymer having a weight-average molecular weight of not less than 2,000, and preferably not less than 5,000, or 10,000. See

'359 publication, paragraph [0157]. The cited reference provides no upper limit for the molecular weight of the cationic polymer. The highest molecular weight for the cationic polymer disclosed in the '359 publication is 70,000 for polyethylenimine. See '359 publication, paragraph [0313], Example 5. The sole example of the '359 publication utilizing a hydrolyzed N-vinylformamide polymer (i.e., CATIOFAST PR8106) is Example 10 in paragraph [0318]. No molecular weight is provided for this polymer.

In addition, the '359 publication further teaches a cation density, e.g., protonatable nitrogen atoms, of not less than 2 mol/kg, and preferably not less than 4 mol/kg or 6 mol/kg. See '359 publication, paragraph [0159]. In the examples, the '359 publication discloses a low cation density, e.g., Example 10 using CATIOFAST PR8106 of cation density 6.1 mol/kg¹⁾. Also see Examples 6, 9, and 11. Example 5 discloses a cationic polymer having a high cation density of 23 mmol/g, but the polymer is a polyethylenimine (which differs from the claimed nitrogenous polymer) having a molecular weight of only 70,000. Example 4 discloses a polymer having a cation density of 11 mol/g, however the polymer is polyallylamine of very low weight average molecular weight 10,000, which again is different from the claimed nitrogenous polymer and is far outside the presently claimed molecular weight range for the nitrogenous polymer.

The '359 publication provides no disclosure with respect to the degree of hydrolysis of the N-vinylformamide homopolymers. However, CATIOFAST PR8106 in Example 10 of the '359 publication, which is specifically relied by the examiner, has a degree of about 90%, as disclosed in Sun et al. U.S. Patent Publication 2003/0135939 ('939 publication) at paragraph [0153]. The relevant pages of the '939 publication are attached as Exhibit A.

The '359 patent clearly fails to teach a nitrogenous polymer having a molecular weight of 100,000 to 500,000 *and* 7.5 to 15 mol/kg protonatable nitrogen atoms *and* a degree of hydrolysis of a homopolymer of N-vinylformamide of 30 to 80 mol%. There

¹⁾ The '359 publication, in the examples, uses mol/g for the cation density. In view of the disclosure at paragraph [0159], mol/g appears to be in error and should be mmol/g or mol/kg. If the values in the examples are in fact mol/g, the cation density is powers of ten different from the protonatable nitrogen atom content recited in the claims.

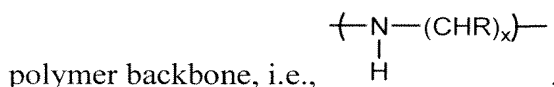
also is no suggestion in the '939 publication for a person skilled in the art to select a nitrogenous polymer a homopolymer of N-vinylformamide, having

- (a) a high weight average molecular weight in the range from 100,000 to 500,000 daltons;
 - (b) a *moderate amount* of from 7.5 to 15 mol/kg, based on the total weight of the nitrogenous polymer, of protonatable nitrogen atoms, or
 - (c) a *moderate degree* of hydrolysis in the range from 30 to 80 mol%,
- let alone *all three* of the features (a), (b), and (c), as presently claimed.

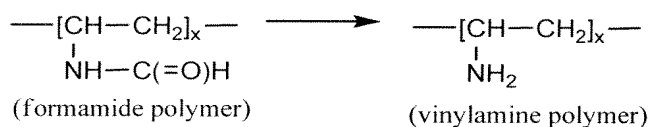
The '359 publication teaches that a low weight average molecular weight of 2,000 and a cation density of not less than 2 mol/kg is still suitable. In contrast, the present claims recite a high weight average molecular weight in combination with a moderate degree of hydrolysis and a moderate content of protonatable nitrogen atoms, which is critical for the present invention and leads to a superior performance profile, as discussed below.

The secondary '938 patent is directed to a process for crosslinking polyalkylenepolyamines. This reference apparently is relied upon for a teaching of a molecular weight of 10,000 to about 1,000,000, and preferably from about 50,000 to about 75,000 (column 2, lines 20-23). However, the '938 patent fails to overcome the deficiencies of the '359 publication.

First, the '938 patent is directed to a polymer *different from* the claimed nitrogenous polymer. The structure of a polyalkylenepolyamine of the '938 patent is set forth at column 1, line 60 through column 2, line 5, e.g., the protonatable nitrogen atoms are in the



The present claims recited a polyvinylamine obtained by hydrolysis of a N-vinylformamide polymer, as shown below:



Furthermore, *not* all of the formamide groups are hydrolyzed to $-NH_2$ groups. As claimed, only a medium amount of hydrolysis is performed, i.e., 30 to 80 mol%. This means that the nitrogenous polymer of the present claims contains 20 to 70 mol% of unhydrolyzed formamide groups.

The polymers of the '938 patent therefore are structurally remote from the claimed nitrogenous polymer. Polyalkylenepolyamines have protonable nitrogen atoms only in the polymer backbone, whereas homopolymers of N-vinylformamide comprise repeating units having a formamide side group that can be subjected to a partial hydrolysis to obtain pendant amine groups bound to the polymer backbone. The polymer of the '938 patent fails to contain any formamide groups, as presently claimed.

The '938 patent also is directed to crosslinking the polyalkylenepolyamine with a polyisocyanate. The presently claimed nitrogenous polymer is not crosslinked. The '938 patent also fails to teach or suggest particles of a water-absorbent polymer as recited in claim 1, and specifically recited in claim 9.

To establish a *prima facie* case of obviousness, the examiner must satisfy three requirements. First, as the U.S. Supreme Court held in *KSR International Co. v. Teleflex Inc. et al.*, 127 S.Ct. 1727 (2007), "a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions. ...it [may] be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was *an apparent reason* to combine the known elements in the fashion claimed by the patent at issue. ...it can be important to *identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements* in the way the claimed new invention does... because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." (emphasis added, *KSR, supra*). Second, the proposed modification of the prior art must have had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *Amgen Inc. v. Chugai Pharm. Co.*, 18 USPQ2d 1016, 1023 (Fed. Cir. 1991). Lastly,

and *importantly* the prior art references must teach or suggest all the limitations of the claims. In *re Wilson*, 165 USPQ 494, 496 (C.C.P.A. 1970).

To reach a proper determination under 35 U.S.C. §103(a), the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information, the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to the person. Knowledge of applicants' disclosure must be put aside in reaching this determination, yet kept in mind in order to determine the "differences," conduct the search, and evaluate the "subject matter as a whole" of the invention. The tendency to resort to "hindsight" based upon applicants' disclosure is often difficult to avoid due to the very nature of the examination process. However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the *facts* gleaned from the prior art. MPEP §2142.

As recently articulated by the Court of Appeals for the Federal Circuit in *Ortho-McNeil Pharmaceutical Inc. v. Mylan Laboratories Inc.*, 86 USPQ 2d, 1196, 1201-2 (Fed. Cir. 2008):

“As this court has explained, however, a flexible TSM test remains the primary guarantee against a non-statutory hindsight analysis such as occurred in this case. *In re Translogic Tech., Inc.* 504 F.3d 1249, 1257 [84 USPQ 2d 1929] (Fed. Cir. 2007) (“[A]s the Supreme Court suggests, a flexible approach to the TSM test prevents hindsight and focuses on evidence before the time of invention.”)

The rationale relied upon by the examiner to support the present rejection apparently is as follows (see Federal Register, Vol. 72, No. 195, October 10, 2007, page 57526 *et seq.*):

"A. Combining Prior Art Elements According to Known Methods To Yield Predictable Results

To reject a claim based on this rationale, Office personnel must resolve the *Graham* factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference;

(2) a finding that one of ordinary skill in the art could have combined the elements as claimed by known methods, and that in combination, each element merely performs the same function as it does separately;

(3) a finding that one of ordinary skill in the art would have recognized that the results of the combination were predictable; and

(4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

In view of the above, a case of *prima facie* obviousness has not been made against the present claims. In particular, the combination of the '359 publication and '938 patent do not teach or suggest all the limitations of the claims and the results of the claimed combination were not predictable.

First, the '359 publication fails to teach or suggest a nitrogenous polymer that is a hydrolysis product of N-vinylformamide having a moderate degree of hydrolysis of from 30 to 80 mol % and a moderate amount of protonatable nitrogen atoms. As set forth above, the '359 publication teaches an N-vinylformamide polymer having a degree of hydrolysis of about 90% (see Example 10 of the '359 publication). The '359 publication provides no apparent reason for a person skilled in the art to modify the teachings of this reference to utilize a moderately hydrolyzed N-vinylformamide polymer. The '938 patent fails to teach a moderately hydrolyzed N-vinylformamide polymer, but rather teaches a polyalkylene-polyamine.

Second, as stated above, the '359 publication discloses a cationic polymer having a weight average molecular weight of not less than 2,000, preferably not less than 5,000 or 10,000, with no upper molecular weight limit. The highest disclosed molecular weight polymer is 70,000. The '359 publication provides no reason for a person skilled in the art to utilize a moderately hydrolyzed N-vinylformamide polymer having a high molecular

weight of from 100,000 to 500,000 Daltons. The highest molecular weight disclosed in the '359 publication is 70,000, but for a different polymer. Again, the '938 patent fails to teach or suggest *any* hydrolyzed N-vinylformamide polymer.

Third, as also discussed above, the '359 publication discloses a low cation density or a high cation density, but not the moderate cation density presently claimed². Again, the '938 patent fails to teach or suggest *any* hydrolyzed N-vinylformamide polymer.

The combination of references fails to teach any of the three claimed features of the nitrogenous polymer, let alone all three. The examiner has failed to identify a reason that would have prompted a person skilled in the art to combine the elements in the way the claimed invention does, as required by the *KSR* decision. The examiner's reasoning at page 5 of the Office Action that protonatable nitrogen content can be adjusted for a specific application is a mere conclusory statement, not supported by facts as required by the *KSR* decision. It must be noted that the present invention relies upon a hydrolyzed N-vinylformamide having a combination of three properties that are not taught or suggested in the '359 publication, the '938 patent, or a combination thereof.

In addition, to support a *prima facie* case of obviousness, a person skilled in the art would have had to recognize that the results of the combination would have been predictable. The superabsorbent art is unpredictable, and is an art wherein it is well known that improving one property (e.g., fluid absorbency) often adversely affects a second property (e.g., permeability).

The claimed combination of molecular weight, degree of hydrolysis, and protonatable nitrogen atoms of the hydrolyzed N-vinylformamide polymer employed in the water absorbent of claim 1 leads to a superior performance profile that is unpredictable from a combination of the cited references. It surprisingly was found that (a) a high weight average molecular weight in combination with (b) a medium content of protonatable nitrogen atoms and (c) a moderate degree of hydrolysis leads to water absorbents that demonstrate a very high fluid transmission performance or permeability (saline flow conductivity, SFC) *and* a

² Except for Example 4 of the '359 publication, but that polymer has a molecular weight of only 10,000 and is different from the claimed nitrogenous polymer.

high wet strength (ball burst strength, BBS). These absorbency properties are unexpected and unpredictable in view of the '359 publication and '938 patent, alone or in combination.

The specification, in Table 1 at page 25, contains a present water absorbent comprising a nitrogenous polymer with 7.5 or 15 mol/kg of protonatable nitrogen atoms and a weight average molecular weight of 400,000 daltons (see specification, page 23, lines 36-42). Examples 1, 4, and 5 are comparative examples. Examples 2 and 3 are examples of the invention. The present examples 2 and 3 clearly demonstrate that a high weight average molecular weight (400,000) *in combination with* a medium content of protonatable nitrogen atoms (7.5 to 15 mol/kg) *and* a moderate degree of hydrolysis (31 to 75 mol %) leads to water absorbents which have a very high SFC and a high BBS. Table 1, page 25 of the specification, shows a dramatic increase in SFC when the content of protonatable nitrogen atoms is raised to 7.5 and hydrolysis is 44 mol% (see Comparative Examples 4 and 5 and Example 3). The same results are observed for BBS at 30 minutes, as well as BBS at 16 hours. Further, Table 1 shows that SFC decreases when the content of protonatable nitrogen atoms is raised above 15 and the degree of hydrolysis is raised above 80 mol %, as in the '359 publication (see Example 2 and Comparative Example 1). The same results are observed for BBS at 30 minutes.

Table 2, on page 26 of the specification, shows that a high weight average molecular weight in combination with a protonatable nitrogen atom content of 7.5 mol/kg added moderate hydrolysis of 44 mol % provides water absorbents that combine a high SFC with a high BBS, and also have good CRC values and AUL values (Examples 8, 9 and 10). See specification, page 24, lines 6-8. The inventive examples also demonstrate an improved storage stability. See specification, page 24, lines 10-27 and Table 2. The presently claimed water absorbents therefore exhibit unexpected results with respect to fluid absorption properties and storage stability that could *not* have been predicted from a combination of the '359 publication and the '938 patent. It also must be noted that the type of polymer disclosed in the '359 publication, i.e., CATIOFAST PR8106 having a degree of hydrolysis of about 90 mol %, is like the polymer used in Comparative Examples 1, 6, and 7 (hydrolysis degree of 95 mol %) did not perform well.

The present claims are closely tailored to (a) the molecular weight of the nitrogenous polymer *and* (b) a moderate amount of protonatable nitrogen atoms, *and* (c) a moderate degree of hydrolysis of the N-vinylformamide polymer, wherein the water absorbents demonstrate unexpected results with respect to performance in absorbing fluids and storage stability. The '359 publication fails to provide any direction, guidance, or apparent reason for a person skilled in the art of superabsorbents to select the narrow range of molecular weights *and* protonatable nitrogen atoms *and* degree of hydrolysis for the N-vinylformamide polymer with any reasonable expectation of providing a water absorbent having unexpectedly improved properties over water-absorbents prepared using cationic polymer disclosed in the '359 publication, either alone or in combination with the '938 patent.

In view of the substantial differences between the present claims and the disclosure of the '359 publication and '938 patent, it is submitted that claims 1, 3, 4, 6, and 8-12 would not have been obvious to a person skilled in the art under 35 U.S.C. §103 over a combination of the '359 publication and the '938 patent. It is further submitted that new claim 13 also is patentable over this combination of references for the same reasons that claims 1, 3, 4, 6, and 8-12 are patentable.

Claim 7 stands rejected under 35 U.S.C. §103 as being obvious over a combination of the '359 publication and Nagasuna et al. U.S. Patent Publication 2004/0019342 ('342 publication). Applicants traverse this rejection.

In particular, claim 7 recites a preferred embodiment of the present invention. Applicants do not rely solely upon the inclusion of a water-insoluble salt for patentability, but rely upon the inclusion of a water-insoluble salt *and* all of the features of claim 1 from which claim 7 depends.

Accordingly, applicants submit that claim 7 is patentable over a combination of the '359 and '342 publications for the same reasons that claims 1, 3, 4, 6, and 8-12 are patentable over the '359 publication. It should be noted that the '342 publication adds nothing to the '359 publication with respect to the patentability of claims 1, 3, 4, 6, and 8-12. The rejection of claim 7 over a combination of the '359 and '342 publication therefore should be withdrawn.

It is submitted that the claims are in a form and scope for allowance. An early and favorable action on the merits is respectfully requested.

Should the examiner wish to discuss the foregoing, or any matter of form in an effort to advance this application toward allowance, the examiner is urged to telephone the undersigned at the indicated number.

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Respectfully submitted,

By 
James J. Napoli

Registration No.: 32,361
MARSHALL, GERSTEIN & BORUN LLP
233 S. Wacker Drive, Suite 6300
Sears Tower
Chicago, Illinois 60606-6357
(312) 474-6300
Attorney for Applicant